



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/806,114	03/23/2004	Shaoping Li	50103-561	2142

49745 7590 12/15/2005

SEAGATE TECHNOLOGY LLC
c/o MCDERMOTT WILL & EMERY LLP
600 13TH STREET, NW
WASHINGTON, DC 20005-3096

EXAMINER

BERNATZ, KEVIN M

ART UNIT	PAPER NUMBER
----------	--------------

1773

DATE MAILED: 12/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/806,114

Applicant(s)

LI ET AL

Examiner

Kevin M. Bernatz

Art Unit

1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>7/6/04</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Drawings

1. Figure 3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.
2. The Examiner notes that the margins of page 2 of the drawings appear to be incorrect. Applicants are recommended to check the margins to confirm that they meet the requirements of MPEP 608.01.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 1 – 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "simultaneously exhibiting increased thermal stability, writability, and signal-to-medium noise ratio ("SMNR")" in claim 1 is a relative term which renders the claim indefinite. The above term is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Specifically, the Examiner notes that the above term is indefinite because the above term is increased relative to what? Since *what* the comparison is being made to is unclear, the term is unclear. For the purpose of evaluating the prior art, the Examiner has taken that any magnetic recording medium meeting the claimed structural limitations will meet the above term since, compared to the very first magnetic recording medium ever created, the Examiner is confident that a medium possessing the disclosed structure will simultaneously possess increased thermal stability, writability and SMNR.

The term "slightly" in claim 1 is a relative term which renders the claim indefinite. The term "slightly" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For purposes of evaluating the prior art the Examiner has interpreted this claim as simply reciting "preselected to be larger". I.e. any value of the exchange coupling strength that is larger than the strength of the anti-ferromagnetic coupling is deemed to meet the claimed limitation.

Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine the claim term and set forth the uncommon definition so as to put one reasonably skilled

in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999). The term “granular” in claim 1 is used by the claim to mean “discontinuous”, while the accepted meaning is “a magnetic film possessing distinct crystal grains vis a vis an amorphous magnetic film.” The term is indefinite because the specification does not clearly redefine the term.

Claim 22 recites the limitation “said at least one non-magnetic interlayer” in 2. There is insufficient antecedent basis for this limitation in the claim since the base claim (claim 1) does not recite a non-magnetic interlayer. For the purpose of evaluating the prior art, the Examiner has interpreted this claim as if it depended on claim 21.

Examiner's Comments

5. Regarding the limitation(s) “continuous” and “granular” in claim 1, the Examiner has given the term(s) the broadest reasonable interpretation(s) consistent with the written description in applicants' specification as it would be interpreted by one of ordinary skill in the art. *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); *In re Donaldson Co., Inc.*, 16 F.3d 1190, 1192-95, 29 USPQ2d 1845, 1848-50 (Fed. Cir. 1994). See MPEP 2111. Specifically, a “granular” ferromagnetic layer is deemed to be a “discontinuous” ferromagnetic layer, i.e. any ferromagnetic layer with substantially exchange de-coupled or weakly/partially coupled grains. Another way of saying this is that the lateral interactions are substantially completely eliminated or suppressed. This includes Co-based films with a high content of non-magnetic material

taught to segregate at the grain boundaries, such as Cr, Ta, Nb, B, oxides, nitrides, borides and carbides.

A "continuous" ferromagnetic layer is deemed to be a ferromagnetic layer possessing magnetic grains which are strongly exchange coupled together. This includes traditional "Co-based" thin films possessing only low to moderate amounts of non-magnetic material which segregate at grain boundaries, as well as superlattice-type magnetic films and rare earth-transition metal (RE-TM) amorphous films.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1 – 5 and 9 – 12, 15, 16 and 19 - 25 rejected under 35 U.S.C. 102(e) as being anticipated by Girt et al. (U.S. Patent No. 6,777,112 B1).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in

the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Girt et al. disclose a magnetic recording medium (*Title*) comprising a layer stack formed on a surface of a non-magnetic substrate (*Figure 2, element 10*) and including: a continuous ferromagnetic (FM) stabilizing layer (*col. 3, lines 35 – 38*), a non-magnetic spacer layer (*col. 3, lines 35 – 38*), and a granular FM layer (*col. 3, lines 35 – 38*), wherein said continuous FM layer and said granular FM layer are antiferromagnetically coupled (AFC) across said spacer layer (*col. 3, lines 63 – 67*) and lateral interactions in said granular FM layer are substantially completely eliminated or suppressed (*i.e. the definition of a "discontinuous" layer as noted above in Paragraph 5*) (see also Girt et al., *col. 4, lines 5 – 13*).

Regarding the limitation "the amount of anti-ferromagnetic coupling preselected to ensure magnetic relaxation after writing", this is an intended use limitation(s) and is not deemed further limiting in so far as the structure of the product is concerned. Note that "in apparatus, article, and composition claims, intended use must result in a **structural difference** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. **If the prior art structure is capable of performing the intended use, then it meets the claim.** In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art." [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. Since the strength of the coupling is well known to depend on

the type of adjacent magnetic layers (*e.g. high Co content leads to improved coupling*) and the thickness of the spacer layer (*e.g. see Girt et al., col. 8, lines 1 – 18*), the Examiner deems that the prior art product is clearly “capable of performing the intended use”.

Regarding the limitation “the exchange coupling strength in said continuous ferromagnetic stabilizing layer is preselected to be larger than the strength of the antiferromagnetic coupling provided by the non-magnetic spacer layer to thereby enhance thermal stability of the recording bits”, it has been held that where claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily or inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. Therefore, the *prima facie* case can be rebutted by **evidence** showing that the prior art products do not necessarily possess the characteristics of the claimed product. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). “When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not.” *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

In the instant case, Girt et al. disclose specific alloys for the continuous layer, reciting that these alloys comprise a very low amount of non-magnetic material in order to "ensure strong magnetic coupling between adjacent grains" (*col. 3, lines 42 – 62*).

Therefore, in addition to the above disclosed limitations, the presently claimed property would have inherently been present because the prior art appears to recognize that a large value of the exchange coupling strength in the continuous ferromagnetic layer is desired for improved thermal stability of the medium (*col. 6, lines 40 – 42; col. 8, lines 18 – 35; col. 8, line 50 bridging col. 9, line 7; and col. 10, lines 13 – 25*).

Regarding claims 2 and 3, Girt et al. disclose structures meeting applicants' claimed limitations (*claim 16*).

Regarding claims 4, 5, 9 and 10, Girt et al. disclose continuous and granular magnetic layers meeting applicants' claimed limitations (*col. 2, lines 55 – 63 and col. 7, lines 36 – 64*). The Examiner notes that longitudinal media inherently have the grains aligned parallel to the surface of the substrate.

Regarding claims 11 and 12, Girt et al. disclose spacer layers meeting applicants' claimed limitations (*col. 3, line 63 bridging col. 4, line 4*).

Regarding claims 15 and 16, Girt et al. disclose media meeting the claimed limitations (*col. 3, line 9 bridging col. 4, line 13*). The Examiner notes that the areal recording density of a medium is not a positive limitation in so far as it applies *solely* to the medium. Specifically, while the structure of the medium (including the substrate) affects the recording density, there are many additional parameters such as head-disk spacing and the type of magnetic/under layers used. The Examiner notes recording

Art Unit: 1773

densities of over 100 Gbit/in², even up to 400 Gbit/in² are known in the art. As such, the areal recording density is only a positive limitation in so far as an apparatus claim is concerned, since it is directed to the combined interaction between the medium and the head used to read and write to the medium. Presently, the claims are directed solely to a medium and for the purposes of evaluating the prior art, the Examiner has interpreted the limitations regarding the areal recording density only as it impacts the structure of the medium.

Specifically, the Examiner notes that the medium *in its entirety* must be capable of achieving the claimed areal recording density, regardless of the relative head-disk spacing. As such, since the disclosed medium is taught to be a “high areal recording density” medium and possesses substantially an identical structure as disclosed by applicants, the Examiner deems that the prior art medium is capable of achieving the claimed areal recording density.

Regarding claims 19 – 25, Girt et al. disclose seed, interlayer, substrates, overcoats and topcoats meeting applicants’ claimed limitations (*col. 6, line 56 bridging col. 7, line 35*).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 6 – 8, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Girt et al. as applied above, and further in view of applicants' admissions.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Girt et al. is relied upon as described above.

Regarding claims 6 – 8, Girt et al. fail to disclose the different media types meeting applicants' claimed limitations.

However, applicants admit that the claimed media types are known equivalent AFC media (*specification, pages 5 – 6 and Figure 3*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Girt et al. to meet the claimed media type limitations as admitted by applicants since the claimed media types are all functional equivalents and substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 17 and 18, applicants admit that perpendicular media comprising soft magnetic "keeper" layers meeting applicants' claimed structural and material limitations are known in the art to serve as guides to the magnetic flux emanating from the head through the perpendicular recording layer (*pages 3 and 21*).

10. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Girt et al. as applied above, and further in view of Oikawa et al. (U.S. Patent App. No. 2002/0136929 A1).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art

Art Unit: 1773

only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(I)(1) and § 706.02(I)(2).

Girt et al. is relied upon as described above.

Girt et al. fail to disclose a granular magnetic layer meeting applicants' claimed composition limitations.

However, Oikawa et al. teach a recording layer comprising a granular magnetic layer meeting applicants' claimed composition limitations for forming high coercive magnetic films with reduced platinum content, and hence reduced cost (*Paragraphs 0012, 0048 and 0049*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Girt et al. to use a granular layer

meeting applicants' claimed composition limitations as taught by Oikawa et al. since such a layer would possess high coercive force along with reduced cost.

11. Claims 1 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda et al. (U.S. Patent No. 6,468,670 B1) in view of Oikawa et al. ('929 A1), Carey et al. (U.S. Patent No. 6,280,813 B1) and applicants' admissions.

Regarding claim 1, Ikeda et al. disclose a magnetic recording medium (*Title*) comprising a layer stack formed on a surface of a non-magnetic substrate (*Figure 1, element "substrate"*) and including: a continuous ferromagnetic (FM) stabilizing layer (*element "Co/Pt Multilayer" and col. 3, lines 12 - 20*), a non-magnetic spacer layer (*element "interface layer"*), and a "granular-type" FM layer (*element "CoCr granular layer" and col. 3, lines 6 - 11*).

Ikeda et al. fail to disclose forming the continuous FM layer and said granular FM layer such that they are antiferromagnetically coupled (AFC) across said spacer layer.

However, Carey et al. teach that using a spacer layer that achieves AFC between two FM layers results in a medium with reduced Mrt without a reduction in thermal stability, thereby achieving higher recording densities (*col. 2, lines 25 – 47*). While Carey et al. is directed to a longitudinal medium structure and Ikeda et al. a perpendicular structure, applicants admit that both structures are known recording media structures and AFC perpendicular media and AFC longitudinal media are art recognized equivalent media structures (*specification, pages 5 and 6, and Figure 3*).

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Ikeda et al. to utilize a AFC spacer layer structure as taught by Carey et al. and applicants' admissions, since such a structure results in a medium with reduced Mrt without a reduction in thermal stability, thereby achieving higher recording densities.

Regarding the limitation "the amount of anti-ferromagnetic coupling preselected to ensure magnetic relaxation after writing", this is an intended use limitation(s) and is not deemed further limiting in so far as the structure of the product is concerned. Note that "in apparatus, article, and composition claims, intended use must result in a **structural difference** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. **If the prior art structure is capable of performing the intended use, then it meets the claim.** In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art." [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. Since the strength of the coupling is well known to depend on the type of adjacent magnetic layers (e.g. *high Co content leads to improved coupling*) and the thickness of the spacer layer (e.g. see *Carey et al.*, col. 3, lines 18 – 52), the Examiner deems that the prior art product is clearly "capable of performing the intended use".

Neither Ikeda et al., applicants admissions, nor Carey et al. teach that the lateral interactions in said granular FM layer are substantially completely eliminated or

suppressed (*i.e. the definition of a "discontinuous" layer as noted above in Paragraph 5*). While Ikeda et al. disclose that the interactions are weak (*Ikeda et al., col. 3, lines 6 - 11*), the Examiner notes that this is deemed to be sufficiently different to not read on the claimed limitation.

However, Oikawa et al. teach a granular recording layer comprising a granular magnetic layer meeting applicants' claimed composition limitations for forming high coercive magnetic films with reduced platinum content, and hence reduced cost (*Paragraphs 0012, 0048 and 0049*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Ikeda et al. in view of applicants' admissions and Carey et al. to use a granular layer meeting applicants' claimed composition limitations as taught by Oikawa et al. since such a layer would possess high coercive force along with reduced cost.

Regarding the limitation "the exchange coupling strength in said continuous ferromagnetic stabilizing layer is preselected to be larger than the strength of the antiferromagnetic coupling provided by the non-magnetic spacer layer to thereby enhance thermal stability of the recording bits", Carey et al. teach that the amount of the exchange coupling in the magnetic layers being coupled antiferromagnetically can be varied to effect the thermal stability and SMNR in a recording medium, specifically that a high exchange coupling strength in a layer will increase the effective magnetic volume, V , which will increase the thermal stability of the layer (*col. 1, lines 46 – 50 and col. 4, lines 38 - 60*). Therefore, the Examiner deems that it would have been obvious to one

having ordinary skill in the art to optimize the amount of the exchange coupling strength in the continuous magnetic layer, including the use of values larger than the strength of the antiferromagnetic coupling provided by the non-magnetic spacer layer, by optimizing the results effective variable through routine experimentation. Such optimization to high values would have been motivated by the known improvement in thermal stability with high exchange coupling strength, curtailed by the recognized decrease in SMNR with too high of an exchange coupling strength *In re Boesch*, 205 USPQ 215 (CCPA 1980); *In re Geisler*, 116 F. 3d 1465, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); *In re Aller*, 220 F.2d, 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Regarding claims 2 and 3, Ikeda et al. disclose structures meeting applicants' claimed limitations (*Figures and col. 5, lines 36 - 48*).

Regarding claims 4, 5, 7, 9, 10, 13 and 14, Ikeda et al. and Oikawa et al. disclose continuous and granular magnetic layers meeting applicants' claimed limitations (*Ikeda et al., col. 5, lines 6 – 36; and Oikawa et al., Paragraphs 0012, 0048 and 0049*). The Examiner notes that longitudinal media necessarily have the grains aligned parallel to the surface of the substrate and perpendicular media necessarily have grains aligned normal to the surface of the substrate.

Regarding claims 6 and 8, applicants admit that the claimed media types are known equivalent AFC media (*specification, pages 5 – 6 and Figure 3*). It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Girt et al. to meet the claimed media type limitations as admitted by applicants since the claimed media types are all functional

equivalents and substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 11 and 12, Carey et al. disclose spacer layers meeting applicants' claimed limitations (*col. 3, lines 18 - 52*).

Regarding claims 15 and 16, Ikeda et al. disclose continuous and granular layer thickness values meeting applicants' claimed limitations and Carey et al. disclose spacer layers meeting applicants' claimed thickness limitations for antiferromagnetic coupling (*Ikeda et al., col. 3, lines 24 – 48; and Carey et al., Figure 3*).

The Examiner notes that the areal recording density of a medium is not a positive limitation in so far as it applies *solely* to the medium for the reasons noted above. Since the disclosed medium is taught to be a "high areal recording density" medium and possesses substantially an identical structure as disclosed by applicants, the Examiner deems that the prior art medium is capable of achieving the claimed areal recording density.

Regarding claims 17 and 18, Ikeda et al. disclose soft magnetic materials meeting applicants' claimed material limitations (*col. 3, lines 24 – 48*). Regarding the thickness limitation, applicants admit that perpendicular media comprising soft magnetic "keeper" layers meeting applicants' claimed structural and material limitations are known in the art to serve as guides to the magnetic flux emanating from the head through the perpendicular recording layer (*pages 3 and 21*).

Regarding claims 19 – 23, Ikeda et al. disclose seed, interlayer and substrates meeting applicants' claimed limitations (*col. 3, lines 24 - 48*).

Regarding claims 24 and 25, Oikawa et al. teach overcoats and topcoats meeting applicants' claimed limitations for improving the protection and lubrication of the medium during use (*Paragraph 0053*).

12. Claims 1, 2, 4, 5, 9 – 14 and 19 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fullerton et al. (U.S. Patent No. 6,383,668 B1) in view of Oikawa et al. ('929 A1).

Regarding claim 1, Fullerton et al. disclose a magnetic recording medium (*Title*) comprising a layer stack formed on a surface of a non-magnetic substrate (*Figure 2, element 21*) and including: a continuous ferromagnetic (FM) stabilizing layer (*element 34*), a non-magnetic spacer layer (*element 36*), and a second FM layer (*element 25*), wherein the continuous FM layer and said second FM layer such that they are antiferromagnetically coupled (AFC) across said spacer layer (*col. 5, lines 49 – 61*)

Regarding the limitation "the amount of anti-ferromagnetic coupling preselected to ensure magnetic relaxation after writing", this is an intended use limitation(s) and is not deemed further limiting in so far as the structure of the product is concerned. Note that "in apparatus, article, and composition claims, intended use must result in a **structural difference** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. ***If the prior art structure is capable of performing the intended use, then it meets the claim.*** In a claim

drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art.” [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. Since the strength of the coupling is well known to depend on the type of adjacent magnetic layers (*e.g. high Co content leads to improved coupling*) and the thickness of the spacer layer (*e.g. see Fullerton et al., col. 4, lines 23 – 50*), the Examiner deems that the prior art product is clearly “capable of performing the intended use”.

Fullerton et al. fail to teach that the lateral interactions in said second FM layer are substantially completely eliminated or suppressed (*i.e. the definition of a “discontinuous” layer as noted above in Paragraph 5*).

However, Oikawa et al. teach a granular recording layer comprising a granular magnetic layer meeting applicants’ claimed composition limitations for forming high coercive magnetic films with reduced platinum content, and hence reduced cost (*Paragraphs 0012, 0048 and 0049*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant’s invention to modify the device of Fullerton et al. to use a granular layer meeting applicants’ claimed composition limitations as taught by Oikawa et al. since such a layer would possess high coercive force along with reduced cost.

Regarding the limitation “the exchange coupling strength in said continuous ferromagnetic stabilizing layer is preselected to be larger than the strength of the antiferromagnetic coupling provided by the non-magnetic spacer layer to thereby

Art Unit: 1773

enhance thermal stability of the recording bits”, the Examiner notes that Fullerton et al. explicitly teach that the films have enhanced thermal stability and that the thermal stability is related to the volumes of the grains, V (*col. 5, line 62 bridging col. 6, line 49*). Fullerton et al. further teach that the amount of the exchange coupling in the magnetic layers being coupled antiferromagnetically can be varied to effect the thermal stability and SMNR in a recording medium, specifically that a high exchange coupling strength in a layer will increase the effective magnetic volume, V , which will increase the thermal stability of the layer (*col. 1, lines 48 – 52*). Finally, Fullerton et al. teach that the films on both sides of the spacer layer are “weakly coupled antiferromagnetically” (*col. 5, lines 49 – 61*).

Therefore, the Examiner deems that there is sound basis to believe that the limitation above is necessarily met by the structures disclosed by Fullerton et al., as described above.

Furthermore, the Examiner deems that even in the event that the above limitation is *not* necessarily met, it would have been obvious to one of ordinary skill in the art at the time of applicants’ invention to modify the device of Fullerton et al. to meet the claimed limitation, given the teachings in Fullerton et al. noted above. Specifically that the antiferromagnetic coupling is weak and that the films possess improved thermal stability due to the volume of the grains, which can be effectively increased by utilizing a magnetic layer having a high exchange coupling strength.

Regarding claim 2, Fullerton et al. in view of Oikawa et al. as described above disclose structures meeting applicants' claimed limitations (*i.e. replacing element 25 with a granular layer*).

Regarding claims 4, 5, 9, 10, 13 and 14, Fullerton et al. and Oikawa et al. disclose continuous and granular magnetic layers meeting applicants' claimed limitations (*Fullerton et al., col. 5, lines 24 - 48; and Oikawa et al., Paragraphs 0012, 0048 and 0049*). The Examiner notes that longitudinal media necessarily have the grains aligned parallel to the surface of the substrate.

Regarding claims 11 and 12, Fullerton et al. disclose spacer layers meeting applicants' claimed limitations (*col. 5, lines 24 - 48*).

Regarding claims 19 – 23, Fullerton et al. disclose seed, interlayer and substrates meeting applicants' claimed limitations (*col. 2, line 66 bridging col. 3, line 22*).

Regarding claims 24 and 25, Oikawa et al. teach overcoats and topcoats meeting applicants' claimed limitations for improving the protection and lubrication of the medium during use (*Paragraph 0053*).

13. Claims 6 – 8, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fullerton et al. in view of Oikawa et al. as applied above, and further in view of applicants' admissions.

Fullerton et al. and Oikawa et al. are relied upon as described above.

Neither of the above disclose the different media types meeting applicants' claimed limitations.

However, applicants admit that the claimed media types are known equivalent AFC media (*specification, pages 5 – 6 and Figure 3*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Fullerton et al. in view of Oikawa et al. to meet the claimed media type limitations as admitted by applicants since the claimed media types are all functional equivalents and substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 17 and 18, applicants admit that perpendicular media comprising soft magnetic "keeper" layers meeting applicants' claimed structural and material limitations are known in the art to serve as guides to the magnetic flux emanating from the head through the perpendicular recording layer (*pages 3 and 21*).

14. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fullerton et al. in view of Oikawa et al. as applied above, and further in view of Igarashi et al. (U.S. Patent No. 6,635,367 B2).

Fullerton et al. and Oikawa et al. are relied upon as described above. Fullerton et al. further disclose spacer layers meeting applicants' claimed thickness limitations

(*col. 5, lines 24 – 48*) and Oikawa et al. disclose granular layers meeting applicants' claimed thickness limitations (*Paragraphs 0012, 0048 and 0049 and examples*).

Furthermore, the Examiner notes that the areal recording density of a medium is not a positive limitation in so far as it applies *solely* to the medium for the reasons noted above. Since the disclosed medium is taught to be a "high areal recording density" medium and possesses substantially an identical structure as disclosed by applicants, the Examiner deems that the prior art medium is capable of achieving the claimed areal recording density.

Neither of the above disclose continuous ferromagnetic layers (*element 34*) meeting applicants' claimed thickness limitations.

However, Igarashi et al. teach that the thickness of magnetic layers in an AFC structure can be varied in a range of 1 – 100 nm (*col. 10, line 22 bridging col. 11, line 36*) and that the thickness will effect the magnetic moment of the magnetic layer, $M_r t$, where M_r is the remanent magnetization and t is the thickness of the layer (see *Fullerton et al.*). Therefore, the Examiner deems that it would have been obvious to one having ordinary skill in the art to determine an optimal magnetic layer thickness of the continuous magnetic layer, including the use of values meeting applicants' claimed thickness limitation, by optimizing the results effective variable (i.e. the thickness of the layer) through routine experimentation. *In re Boesch*, 205 USPQ 215 (CCPA 1980); *In re Geisler*, 116 F. 3d 1465, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); *In re Aller*, 220 F.2d, 454, 456, 105 USPQ 233, 235 (CCPA 1955).

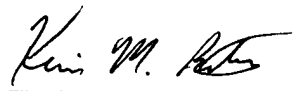
Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB
December 7, 2005


Kevin M. Bernatz, PhD
Primary Examiner